made in mitochondria and chloroplasts, those destined for locations outside the cytoplasm must first be translocated across a membrane. Proteins translocated into mitochondria or chloroplasts are sometimes further translocated across the internal membranes in these organelles. The other method cells use to move proteins between compartments is vesicular transport, which is employed in the secretory and endocytic pathways.

For students and those not working on protein trafficking, getting a handle on the field, particularly protein trafficking in the secretory and endocytic systems, can be a daunting task. Surprisingly, there have been few recent books on the subject aimed at students. *Protein Targeting Transport & Translocation* does a good job of filling that gap. Rather than an integrated overview of the subject, the book is a compendium of review articles on a variety of topics. Most chapters are written very clearly and give students both a sense of how the field has developed and what we know now. The book begins with a chapter by Dalbey, Chen, and Wiedmann that briefly describes the many methods used to study protein transport and translocation. Though parts of the chapter are not as clear as they could be, it provides a good short introduction to the many ways protein transport is studied and should be particularly useful to students. The book goes on to focus more on the question of how proteins are translocated across (or into) membranes, with nine chapters on various aspects of protein targeting and translocation and only three on protein transport in the secretory and endocytic pathways. There are also chapters on the unfolded protein response (Sidrauski, Brickner, and Walter) and disulfide bond formation (Regeimbal and Bardwell).

The last few years have witnessed steady progress in our understanding of the many ways cells target and translocate proteins across membranes. These processes are studied in a variety of systems. However, in no case do we yet understand translocation in physicochemical terms. What we do know is discussed in depth in chapters on protein translocation into the endoplasmic reticulum (Haigh and Johnson), the periplasm in bacteria (Driessen and van der Does), mitochondria (Prinz, Pfanner, and Truscott), cholorplasts (Soll, Robinson, and Heins), and peroxisomes (Subramani et al.). There is also an excellent review of nucleocytoplasmic transport in the chapter by Görlich and Jäkel. Although it is impossible to be comprehensive in a book with such a wide scope, it would have been nice to see more on protein translocation in prokaryotes. There is relatively little on the recently discovered twin-arginine translocation (Tat) pathway, which can move fully folded proteins across the cytoplasmic membrane, and almost nothing on type III secretion systems. These systems are often found in pathogens and have the remarkable ability to move proteins across a number of membranes directly from the cytoplasm of a pathogen into a host cell.

Some of the most interesting unresolved questions in protein translocation concern the insertion of integral membrane proteins. These include how the orientation of transmembrane sequences is determined, how translocation channels can be laterally gated to allow transmembrane sequences to enter the membrane, and how polytopic membrane proteins are inserted. The chapter by Kuhn and Spiess nicely summarizes these and many important related issues.

Another fascinating topic in protein translocation has arisen from the recent discovery that cells can move misfolded proteins and some toxins out of the ER. Retrograde translocation, as the process is sometimes called, is the subject of a thoughtful chapter by Kostova and Wolf, and likely occurs through the same channel used to move proteins into the ER. How proteins are targeted for dislocation and the energy source for this process remain the subject of intense investigation and are discussed along with many other topics.

The chapters on protein transport in the secretory and endocytic pathways, while being far from comprehensive, do a fine job of covering a lot of ground briefly. The chapters on secretion (Glick) and vesicular trafficking (Ostermann, Stauber, and Nilsson) are both very clear and succinctly summarize the many current controversies about the nature of trafficking in the Golgi apparatus and the role of SNAREs and other proteins in vesicular trafficking. There is also a good chapter on protein transport to the yeast vacuole by Graham and Nothwehr.

Overall, this book provides good summaries of what we know about how proteins are moved between intracellular compartments and how we have studied this problem. Students or anyone wanting to know more about protein trafficking, particularly protein translocation across membranes, will find it a useful guide.

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Gripping Tales of Bacterial Pathogenesis

Bacterial Adhesion to Host Tissues: Mechanisms and Consequences
Edited by Michael Wilson
Cambridge: Cambridge University Press (2002).
328 pp. $90.00

There is one fact that reliably arouses amazed murmurs in an introductory microbiology audience: within the human body, microbes outnumber our own cells by at least one order of magnitude. When considering this extraordinary microbial burden, which is mostly comprised of bacteria, one gains a great appreciation for the interspecies crosstalk that continuously reverberates within us all. This crosstalk, at its best, can help shape our development and aid our digestive processes and, at its worst, can send us to an early grave. Whether a bacterium triggers illness or coexists peacefully within our system often depends on where a microbe is able to set up shop. Strains of *Escherichia coli*, for example, may be quite innocuous, and even beneficial, as part of the immense microflora of the human gut, but their presence within the bloodstream, brain, or urinary tract can have disastrous effects on the host. Arguably, the primary factors that dictate the tissue tropism of a microbe, and hence its capacity to cause disease, are its adhesive properties. Bacterial pathogens that can't stick to target cells and tissues are usually rapidly dispatched from the host.

Adhesion does not occur by any protocol that is standardized among bacterial species or environmental situations. Bacteria produce a number of products that can mediate adherence, including proteins, lipopolysaccharides, and lipoteichoic acid. Adhesive molecules (adhesins) may be presented distally on hair-like fibers called pili (aka fimbriae) or directly expressed on the bacterial surface. Adhesins can interact with a wide range of host receptor proteins, glycoproteins, glycolipids, and other molecules on host cells, with extracellular matrix proteins, or even with organic and inorganic films deposited on teeth and medical implants. In order to bind, physical forces—van der Waals, hydrophobic, and electrostatic repulsions—must be overcome. Many bacteria make use of several structures to synergistically enhance adherence to a particular substrate, and may also encode within their genetic repertoire other sets of adhesins for binding alternate attachment surfaces. Adhesins can mediate interbacterial interactions as well, facilitating genetic exchange and biofilm formation.

The attachment event can trigger dramatic responses in both bacterial and host cells that can directly impact the outcome of an infection. Bacterial attachment that results in the intimate positioning of bacterial components such as lipopolysaccharide near host cell receptors can simultaneously enhance both host inflammatory responses and bacterial expression of toxins and other virulence factors. Our bodies have evolved strategies to thwart bacterial attachment, such as lining the more vulnerable tissues with mucus and/or cilia, and continually shedding many mucosal and epithelial surfaces. Still, bacteria manage to find their way into niches that most of us would prefer remain sterile. With the increasing frequency of antibiotic-resistant bacterial infections, adhesion, the crucial first stage, is gaining increased attention from microbiologists and others interested in exploring new targets for preventing and treating major infections.

During the 1990s, cellular microbiology emerged as a bona fide discipline, complete with its own specialized journals and symposia. This area of study, which is focused at the interface between cell biology and microbiology, aims to expand our understanding of how bacteria manage to live and thrive within host cells and tissues. Now, into the midst of this explosive field comes *Bacterial Adhesion to Host Tissues*, the first book in a series entitled *Advances in Molecular and Cellular Microbiology*. This book has the ambitious goal of defining the mechanisms and consequences of bacterial adherence, providing both a broad view and an examination of current research.

The book covers a variety of gram-negative and gram-positive organisms that target the skin, oral cavity, respiratory tract, gut, and urogenital tract with varying degrees of pathogenicity. As a whole, this work does provide a reasonable overview of bacterial adhesion. However, there is little sense of cohesion and a notable amount of redundancy between chapters. Often, we felt as if we were reading loosely connected back-to-back review articles pulled from PubMed. Each chapter, to the authors' credit, stands on its own and most provide some genuinely fascinating information. The book also benefits from a number of exceptional diagrams and micrographs. However, several hoped-for figures appear too late, not at all, or with only the blurry quality of Sasquatch-sighting photos.

A great deal of ink is used describing the regulation of adhesin-coding genes. Though this is certainly interesting and valuable information to researchers in the field, more detail on the adhesins themselves would have been useful. Particularly noticeable is a paucity of discussion on the wealth of detailed adhesin structural data that now exists. In the past eighteen months, for example, high-resolution structures of the adhesins internalin A and B of *Listeria monocytogenes* (Schubert et al., J. Mol. Biol. *312*, 783–794, 2001) and PapGII of uropathogenic *E. coli* (Dodson et al., Cell *105*, 733–743, 2001; Sung et al., EMBO Rep. *7*, 621–627, 2001) have been reported. These and similar biophysical data provide detailed insight into how adhesion occurs at the molecular level, and a more extensive discussion regarding structure-function analyses would have been welcome.

This volume does present a wealth of useful and at times intriguing information. Its major problem is not content, but packaging. As it stands, one of the most useful features of the book is probably its index; it will be handy for finding a quick reference to a description of an injectisome, or the hemagglutinating properties of various pathogens. With increased introductory information, some improved graphics, and perhaps some revision to improve overall flow, it could become a far more readable, and thus more thoroughly usable, work.

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The Bugs amongst Us

Bacterial Disease Mechanisms: An Introduction to Cellular Microbiology
By M. Wilson, R. McNab, and B. Henderson
Cambridge: Cambridge University Press (2002).
656 pp. $150.00

The global increase in drug resistance coupled with the specter of bioterrorism has fueled recent interest in elucidating how infectious bacteria cause disease. Despite this recent attention, the current renaissance in the microbial pathogenesis field has, in fact, been gaining momentum since the mid 1980's. It was then that researchers, in particular Stanley Falkow and his colleagues, first demonstrated that prokaryotic cells interact specifically with eukaryotic cells to alter the host for the benefit of the pathogen. The groundswell of interest in these findings led to the emergence of a new field, termed cellular microbiology, in which the disciplines of cell biology and microbiology are integrated. Importantly,